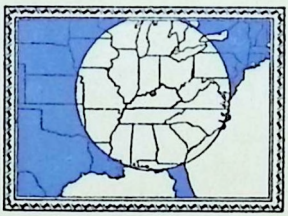
MINERAL RESOURCES

of the

LOUISVILLE

District



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Jun16 78			
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DEC 1 6 1982			
DEC 7	1982		
GAYLORD			PRINTED IN U.S.A.

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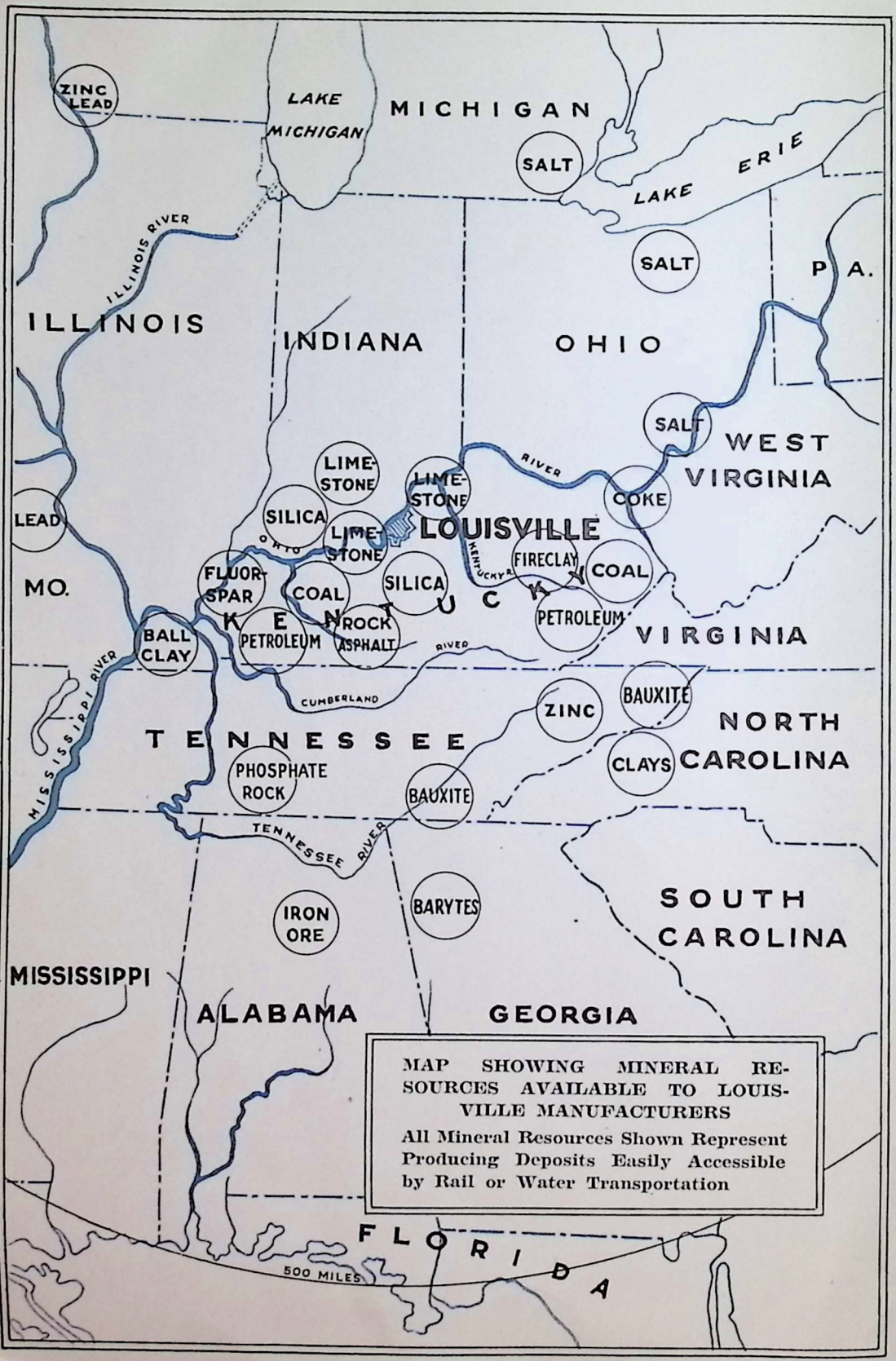


MAP SHOWING MINERAL RESOURCES AVAILABLE TO LOUISVILLE MANUFACTURERS

All Mineral Resources Shown Represent Producing Deposits Easily Accessible by Rail or Water Transportation

INTRODUCTION

THIS pamphlet summarizes in the briefest possible manner the principal mineral resources of Kentucky and adjoining states, from which raw materials may be drawn for industrial operations at Louisville.

No attempt has been made to include detailed information regarding the occurrence of the various minerals or concerning the statistics relating to their production, since such information is readily available from the conventional sources suggested below. Mention is made only of those mineral resources which are being exploited commercially in operations of sufficient size and stability so that presumably they might be relied upon as consistent sources of raw materials for Louisville manufacturers.

For detailed information regarding the mineral resources summarized herein, reference should be made to the standard works on economic geology, as well as to publications such as "The Mineral Industry" (published annually by McGraw-Hill Book Co., New York) and the publications of the United States Geological Survey, the United States Bureau of Mines, and the Departments of Geology of the various states concerned. These sources have been drawn on freely in the preparation of this summary.

Advantageous Location and Transportation Facilities of Louisville

Louisville is located on the canalized Ohio River and at the junction point of eight major trunk-line railway systems. These media give its industries unsurpassed facilities for drawing upon the mineral wealth of Kentucky and its adjoining states for supplies of raw materials. The investment by the United States Government of many hundred millions of dollars in the canalization of the Mississippi, the Ohio, and their tributary

rivers has created a great inland waterways system which provides a nine-foot stage for water-borne traffic from Pittsburgh, on the Ohio, and from a point well above St. Louis on the Mississippi, to the Atlantic and Pacific Oceans through New Orleans. Additional territory of vast extent is accessible to water traffic of four-foot and six-foot draught. At Louisville facilities are available for the transfer of materials from river barges direct to a belt-line railway which serves the industrial sections of the city and acts as a feeder for the eight major trunk-line railway systems which enter the city. These systems are: The Louisville and Nashville; the Pennsylvania; the New York Central (Big Four); the Illinois Central; the Chesapeake and Ohio; the Southern; the Baltimore and Ohio; and the Chicago, Indianapolis and Louisville (Monon Route). A terminal belt-line railway (Kentucky and Indiana Terminal R. R.) owned jointly by the three last-named railroads, serves the industrial districts of the city and provides switching facilities to and from all lines entering the city.

FUEL

Coal

The vast deposits of bituminous coal occurring in Kentucky are extensively worked in both the Eastern and Western Districts of the state. The output of these two districts comprises a wide variety of coals, suitable for any industrial requirement, and the immense reserves within the state insure an adequate supply for Louisville industries far beyond the period over which business plans ordinarily are projected.

Coals of the Western Kentucky Field, in general, are characterized by relatively high sulphur content and fusible ash and are used principally for steam raising and domestic heating; only a small proportion being suitable for the manufacture of by-

MAP SHOWING RESOURCES IN BITUMINOUS COAL EASILY AVAILABLE TO LOUISVILLE MANUFACTURERS

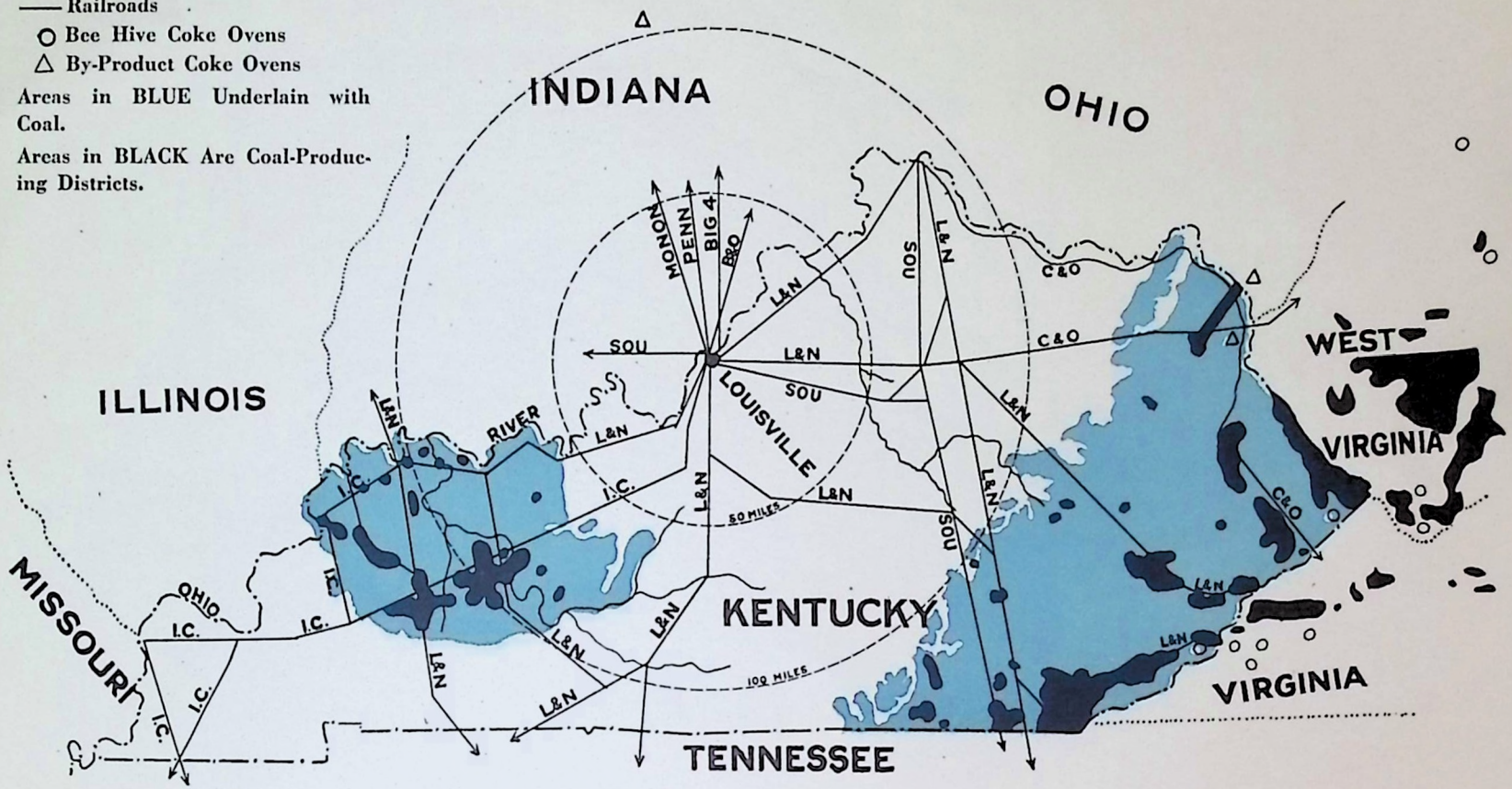
—— Railroads

○ Bee Hive Coke Ovens

△ By-Product Coke Ovens

Areas in BLUE Underlain with Coal.

Areas in BLACK Are Coal-Producing Districts.



product coke. Analyses of coal as received from this field will run approximately as follows:

Western Kentucky "No. 9" Seam

	Per Cent
Moisture	8.65
Volatile matter	35.05
Fixed carbon	46.75
Ash	9.55
Sulphur	3.30
B. t. u. per pound	11,900

The freight rate from points in the Western Kentucky Field to Louisville is $1.26 per net ton.

Eastern Kentucky coals, in general, are of relatively high calorific value, are low in sulphur and produce ash of high fusion point. They are adaptable particularly to the manufacture of by-product coke and of illuminating gas. The following analyses are representative of the better grades of Eastern Kentucky coals (as received basis):

Eastern Kentucky Coal

	HAZARD "No. 4" Per Cent	HARLAN SEAM Per Cent
Moisture	2.20	2.00
Volatile matter	36.75	36.15
Fixed carbon	57.85	57.75
Ash	3.20	4.10
Sulphur	0.80	0.60
B. t. u. per pound	14,110	14,300

The freight rates from points in the Eastern Kentucky Field to Louisville range from $1.69 to $1.79; the rate from the Hazard District being $1.69 and from the Harlan District $1.79 per net ton.

Kentucky mines produced 63,255,000 tons of coal in 1928, ranking third among the states.

Coke

By-product coke is produced at Indianapolis, Ind. (111 miles) and Ashland, Ky. (208 miles). The operation at Ashland (Ashland By-Product Coke Company) and its subsidiary at Ironton, Ohio (Ironton By-Product Coke Company) are units of the Semet-Solvay Company. The Ashland plant has a capacity of 2,200 tons of coal per day and the Ironton plant a capacity of 1,300 tons. Both plants produce foundry, furnace, and domestic cokes from coal mined in the Elkhorn District of the Northeastern Kentucky Field.

The sulphur content of the coke produced at Ironton is unusually low; namely 0.45 per cent. Coke produced at Ashland averages slightly higher in sulphur—about 0.60 per cent.

The freight rate on coke from Indianapolis to Louisville is $2.14 per net ton. The rail rate from Ashland and Ironton is $2.37 and the river rate is $1.75; river rates, however, being dependent upon tonnage and upon contract arrangement between carrier and consignee.

Bee-hive coke is produced in the Eastern Kentucky Field at Rockhouse (32 ovens) and at Benham (408 ovens). The extension of the Eastern Kentucky Coal Field into the adjoining states of Virginia and West Virginia is the scene of extensive bee-hive coking operations. A large section of this district, producing over 1,000,000 tons (net) of coke from 9,000 ovens, is within the zone of $2.37 freight to Louisville.

Petroleum Coke

Louisville oil refineries have a combined capacity of about 5,500 barrels of crude per day and moderate demands for petro-

leum coke can be supplied from this source. This coke has a heating value of about 14,600 B. t. u. per pound. Other large refineries are located at Lawrenceville, Ill., 185 miles from Louisville.

Natural Gas

Louisville is supplied with natural gas drawn from the Eastern Kentucky-West Virginia and Indiana Fields. The heating value of this natural gas is 1,130 B. t. u. per cubic foot. During the winter season the natural gas supply is supplemented with manufactured gas, which produces a mixture having a calorific value of approximately 875 B. t. u. per cubic foot.

Fuel Oil

Louisville refineries can supply carload lots of fuel oil of from 15 to 21 degrees Baumé gravity.

PETROLEUM

Petroleum production is well distributed throughout Kentucky, over thirty counties having contributed to a total output of 7,325,291 barrels in 1928. The principal producing counties were Ohio, Lee, Magoffin, Daviess, Hancock, Johnson, Warren, Estill, Allen, Lawrence, and Powell. Refineries with a total daily capacity of 5,500 barrels of crude oil are located at Louisville and additional refineries totaling about 10,000 barrels per day capacity are located at Ashland, at Pryse, at Louisa, and at Latonia, Ky.

CARBON BLACK

Carbon black from natural gas is extensively produced in eastern Kentucky, the state being credited with an output of 5,669,000 pounds in 1927.

PHOSPHATE ROCK

Large deposits of high-grade phosphate rock occur in Tennessee and are extensively worked in a district centering on Mt. Pleasant, giving Tennessee second rank among the producing states. The freight rate on rock from Mt. Pleasant to Louisville is $2.81 per net ton.

Brown rock phosphate deposits of considerable extent occur in Central Kentucky and these offer certain possibilities of commercial development, but production from this source is unimportant at the present time.

FLUORSPAR

The Kentucky Fluorspar Field, together with its extension in Illinois, forms the principal domestic source of this mineral. Kentucky mines produced 57,495 tons in 1927, ranking second among the states in volume of output. The freight rates from typical producing points to Louisville are:

	Rate per Net Ton
Rosiclare, Ill.	$3.90
Marion, Ky.	2.10

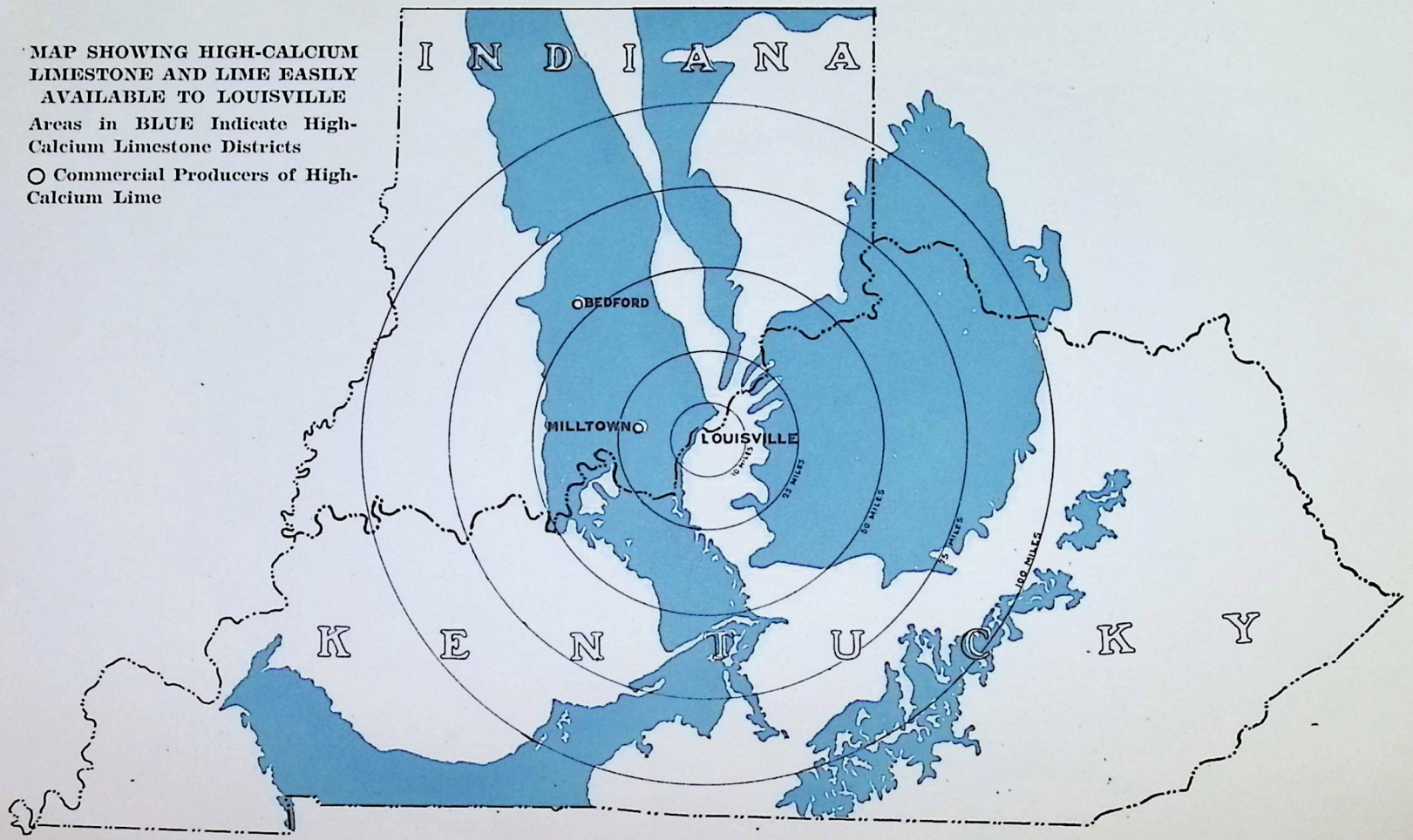
LIMESTONE

A wide variety of limestones and limes, ranging from agricultural (magnesian) to chemical (high-calcium) are available at Louisville. The nearest point of production of chemical lime is at Milltown, Ind. (33 miles), from which point the freight rate to Louisville is $0.70 per net ton on crushed limestone and

MAP SHOWING HIGH-CALCIUM LIMESTONE AND LIME EASILY AVAILABLE TO LOUISVILLE

Areas in BLUE Indicate High-Calcium Limestone Districts

○ Commercial Producers of High-Calcium Lime



$1.60 per ton on burned lime. Materials from this source are represented by the following analyses:

	Limestone Per Cent	Burned Lime Per Cent
$CaCO_3$	97.32	.....
CaO	.....	96.44
$MgCO_3$	1.61	.....
MgO	.....	0.72
SiO_2	0.74	0.60
R_2O_3	0.33	0.80
Loss on ignition	.....	0.85

The famous Bedford (oölitic) building limestone is extensively quarried in a district centering on Bedford, Indiana, about 80 miles from Louisville.

SALT

The nearest point of large-scale production of salt is in the Northern Ohio District, principally at Rittman, on the Baltimore and Ohio Railroad. Three grades of evaporated salt are available at this point, representative analyses being as follows:

	Per Cent		
Grade	NaCl	$CaSO_4$	$CaCl_2$
High analysis	99.80	Diff.	Trace
Purex	99.3–99.7	Diff.	Trace
Commercial	98.8–99.3	Diff.	Trace

The freight rate to Louisville from the Rittman plant is $3.80 per net ton.

Rock salt is available to Louisville from the mines in the Salt Island District of Louisiana. Although the freight rate to Louisville from this field is $5.00 per net ton, the differential between this rate and that applying to the Northern Ohio and Michigan Fields is commonly absorbed by the sellers, so that the commodity is sold f. o. b. Louisville in competition with Ohio and Michigan salt. River transportation eventually should

serve to bring Louisiana salt into Louisville at a considerable saving over present rates. Rock salt from Louisiana is typically of the following composition:

	Per Cent
Moisture	0.062
$CaSO_4$	0.171
$CaCO_3$	0.182
NaCl	99.645

In West Virginia, notably along the Gauley River and on the Ohio River in the vicinity of Malden and Pomeroy, salt is manufactured by the evaporative process from brines obtained from wells drilled to the Pottsville or Berea formations. The salt produced in this district is typified by the following analysis:

	Per Cent
$CaCl_2$	1.49
$MgCl_2$	0.62
$BaCl_2$ under	0.01
Moisture	4.54
Salt	93.34

The production of the West Virginia District is not large, constituting less than two per cent of the country's output of manufactured salt. Production also is somewhat seasonal and the output normally is absorbed in the local market. Brines of the character utilized by the West Virginia plants may be obtained at lesser depths in the vicinity of Louisville; in fact a flourishing salt industry formerly existed along the Ohio River west of the city.

CLAYS

The following paragraphs are quoted from "Kentucky's Mineral Resources", a Publication of Kentucky Geological Survey, No. 13, Series VI, p. 14:

"Situated in the heart of the Ohio Valley and in that part of the watershed which has been slightly glaciated, Kentucky is

rich in clays and shales of all descriptions. These are suitable for brick, tile, pottery, and thermo-metallurgical purposes. Residual clays necessary for domestic use are found above stream level at almost any point in this state. Transported clays occur throughout the greater portion of all the major streams of the commonwealth. This is particularly the case along the Ohio and Mississippi Rivers.

"Highly desirable carboniferous fire clays occur in Northeastern Kentucky in association with very high-grade flint fire clays. Tertiary, ball and sagger clays are well distributed throughout the Jackson Purchase region, and pottery clays of Pliocene age suitable for manufacture of art and domestic stoneware occur in Madison, Franklin, Anderson and other North-central Kentucky counties closely bordering the Kentucky River." The clay and clay products industry of Kentucky in 1926 had a production valued at $8,383,634.

ROCK ASPHALT

Kentucky is the largest producer of native rock asphalt having marketed 320,430 tons of this mineral in 1926 from the large deposits in Edmonson, Grayson, Hart, Warren, Hardin, Johnson, and Breckinridge counties. Much of the available material is located along the navigable Green River and tributaries, and most of it is within an 80-mile radius from Louisville. The Kentucky Rock Asphalt Company is a very large producer in this field.

BARYTES

Barytes (barium sulphate) is produced extensively in the following locations: The Cartersville District of Northwestern Georgia; Washington County, Missouri; the Sweetwater District in Tennessee; and in Fayette, Boyle, Garrard, Mercer, and

Woodford counties, Kentucky. Production in the Kentucky districts is relatively small but is believed to be capable of considerable expansion.

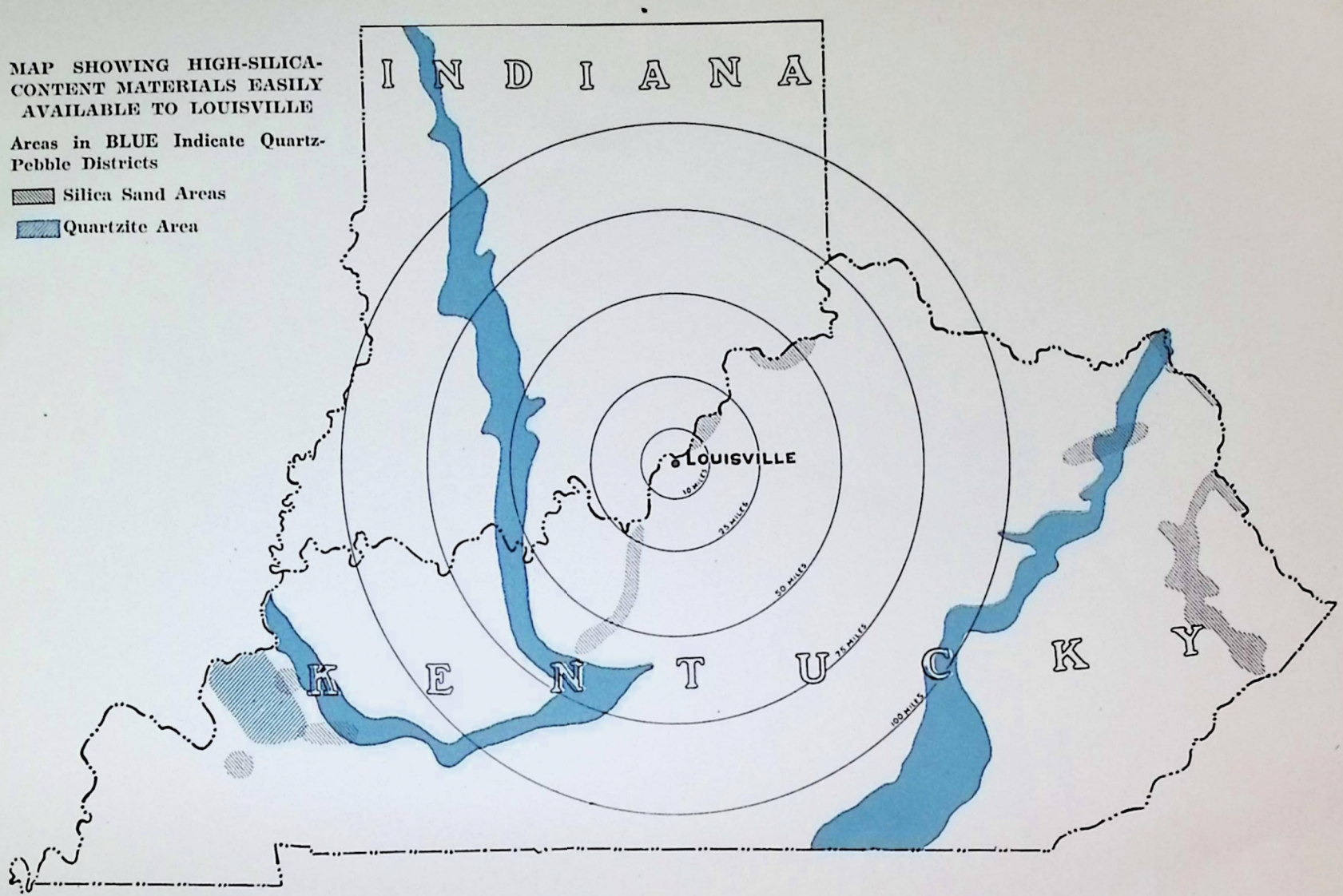
SILICA

High-silica minerals are available in Kentucky and Southern Indiana in the form of quartz pebble conglomerate and of massive quartzite. Sand formation, said to contain 99 per cent plus silica is being quarried and shipped by the Kentucky Silica Co., Inc., from its property at Tip Top, Hardin County, Kentucky. The freight rate on silica from this point to Louisville is 60 cents per net ton.

The quartz pebble conglomerate is available at many points in both Eastern and Western Kentucky as indicated by the accompanying map. There is no organized production from these deposits but quarries could advantageously be opened at any one of several points within the zone of $1.20 freight to Louisville. The quartz pebble material commonly contains upward of 96 per cent silica.

ZINC

Louisville is well located for securing supplies of zinc concentrates from any of the three eastern producing fields; Tri-state (Oklahoma-Kansas-Missouri); Wisconsin-Illinois; and Mascot (Tennessee). In the case of zinc produced in the Tri-state District, Louisville is located approximately upon the line of travel of the ore from mine to market and it is logical that it should be smelted or otherwise processed at this point. A commodity rate of $3.83 per net ton has been established for zinc concentrates from the Mascot District to Louisville. It is expected that a rate of $4.40 per ton will be established in the near future on concentrates from Tri-state points to Louisville.


MAP SHOWING HIGH-SILICA-CONTENT MATERIALS EASILY AVAILABLE TO LOUISVILLE
Areas in BLUE Indicate Quartz-Pebble Districts
Silica Sand Areas
Quartzite Area
INDIANA
LOUISVILLE
10 MILES
25 MILES
50 MILES
75 MILES
100 MILES
KENTUCKY

BAUXITE

Demands of Louisville industries for bauxite in moderate tonnages may be supplied from extensive operations in Arkansas, or from lesser deposits in Georgia, Alabama and Tennessee. Due to the heavy requirements of the aluminum industry, not much domestic bauxite is available, in fact, the reserves have been depleted to a point where production is falling steadily and foreign sources are coming to be relied on to supply domestic requirements in this mineral. Those interested in the subject should consult the chapter on aluminum and bauxite in "Mineral Industry", an annual published by McGraw-Hill Book Co., New York, which contains, in any given year, an up-to-date review of the subject.

SULPHUR

The sole sources of native sulphur available to the Louisville district are the Texas deposits which, in fact, supply upward of 90 per cent of the domestic requirements. The present all-rail rates to Louisville on sulphur from the producing districts in Texas are $9.30 per gross ton or $8.30 per net ton. Sulphur is being transported on the Mississippi and Ohio Rivers from New Orleans to Pittsburgh and it is probable that large tonnage requirements at Louisville could be handled very economically in this manner.

OCHRE

That area of Western Kentucky known as the Jackson Purchase carries large beds of yellow ochre. Bartow County, Georgia, produces approximately one-half the yellow ochre output of the United States. Deposits of red and brown ochre are found in Tennessee and Alabama.

BENTONITE

Bentonite is found to extend from Jefferson County, Alabama, on the south, to Jessamine County, Kentucky, on the north, a distance of 300 miles.

WATER

River Water

The water supply of Louisville is taken from the Ohio River and filtered in a municipally-owned, slow-sand plant having a capacity of 145,000,000 gallons per day. The maximum demand has never exceeded 60,000,000 gallons per day, while the average daily consumption is 42,010,333 gallons. Extensive improvements and additions are being made to the pumping station and filter plant, which is in keeping with the water company's policy of having the capacity of their plant in advance of actual demand.

Well Water

A number of plants are supplied with well water, excellent for process purposes, from wells on their premises—water being struck at a depth of 50 feet or less, at an average pumping cost of ¼c per 1,000 gallons. The city water is very good for boiler purposes, but well water does not as fully meet the requirements. In comparison, the city water is about 10 degrees softer.

Analyses

Analyses of both river and well water made by a nationally known authority follow:

ARTHUR D. LITTLE, INC.
CHEMISTS—ENGINEERS—MANAGERS
30 CHARLES RIVER ROAD CAMBRIDGE 39, MASS.

CERTIFICATE

Case No. 39686. August 23, 1928.
Sample No. A-66424.
Sample of Water.
Marked Filtered River.
Submitted by Louisville Industrial Foundation.
Received July 27, 1928.

Color	Less than 5
Turbidity	Very Slight

	Grains Per U. S. Gallon	Parts Per Million
Silica, SiO_2	1.03	17.667
Iron Oxide, Fe_2O_3	0.01	.171
Alumina, Al_2O_3	0.14	2.401
Calcium Oxide, CaO	2.37	40.651
Magnesium Oxide, MgO	0.50	8.576
Sodium Oxide, Na_2O	0.35	6.003
Chlorine, Cl	0.70	12.006
Sulfur Trioxide, SO_3	2.54	43.567
Probably combined as follows:		
Silica, SiO_2	1.03	17.667
Iron Oxide, Fe_2O_3	0.01	.171
Alumina, Al_2O_3	0.14	2.401
Sodium Chloride, NaCl	0.66	11.320
Magnesium Chloride, $MgCl_2$	0.40	6.861
Calcium Sulfate, $CaSO_4$	4.32	74.099
Calcium Carbonate, $CaCO_3$	1.05	18.010
Magnesium Carbonate, $MgCO_3$	0.69	11.835
Organic & Volatile Matter	1.64	28.130
Residue on Evaporation	9.94	170.497

Respectfully submitted,

HCP–EAG ARTHUR D. LITTLE, Inc.

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ARTHUR D. LITTLE, INC.
CHEMISTS—ENGINEERS—MANAGERS
30 CHARLES RIVER ROAD CAMBRIDGE 39, MASS.

CERTIFICATE

Case No. 39686. August 23, 1928.
Sample No. A-66423.
Sample of Water (composite, representing average conditions).
Marked Raw River.
Submitted by Louisville Industrial Foundation.
Received July 27, 1928.

Color	50	
Turbidity	Decided	
Suspended Matter	7.60*	130.360‡

ANALYSIS OF FILTERED WATER

	Grains Per U. S. Gallon	Parts Per Million
Silica, SiO_2	2.48	42.538
Iron Oxide, Fe_2O_3	0.05	.857
Alumina, Al_2O_3	0.15	2.572
Calcium Oxide, CaO	2.50	42.881
Magnesium Oxide, MgO	0.57	9.777
Sodium Oxide, Na_2O	0.55	9.433
Chlorine, Cl	0.87	14.922
Sulfur Trioxide, SO_3	1.49	25.557
Probably combined as follows:		
Silica, SiO_2	2.48	42.538
Iron Oxide, Fe_2O_3	0.05	.857
Alumina, Al_2O_3	0.15	2.572
Sodium Chloride, NaCl	1.04	17.838
Magnesium Chloride, $MgCl_2$	0.32	5.488
Calcium Sulfate, $CaSO_4$	2.53	43.396
Calcium Carbonate, $MgCO_3$	2.61	44.768
Magnesium Carbonate, $MgCO_3$	0.90	15.437
Organic and Volatile Matter	1.35	23.156
Residue on Evaporation	11.43	196.054

*Grains per U. S. Gallon.
‡Parts per Million.

Respectfully submitted,
ARTHUR D. LITTLE, Inc.

HCP–EAG.

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ARTHUR D. LITTLE, INC.
CHEMISTS—ENGINEERS—MANAGERS
30 CHARLES RIVER ROAD CAMBRIDGE 39, MASS.

CERTIFICATE

Case No. 39686. August 23, 1928.
Sample No. A-66425.
Sample of Water.
Marked Well.
Submitted by Louisville Industrial Foundation.
Received July 28, 1928.

Color	10
Turbidity	Very Slight

	Grains Per U. S. Gallon	Parts Per Million
Silica, SiO_2	3.06	52.487
Iron Oxide, Fe_2O_3	0.02	.343
Alumina, Al_2O_3	0.17	2.915
Calcium Oxide, CaO	6.95	119.210
Magnesium Oxide, MgO	2.38	40.823
Sodium Oxide, Na_2O	0.73	12.521
Chlorine, Cl	2.45	42.024
Sulfur Trioxide, SO_3	2.57	44.082
Probably combined as follows:		
Silica, SiO_2	3.06	52.487
Iron Oxide, Fe_2O_3	0.02	.343
Alumina, Al_2O_3	0.17	2.915
Sodium Chloride, NaCl	1.38	23.670
Magnesium Chloride, $MgCl_2$	2.16	37.049
Calcium Sulfate, $CaSO_4$	4.37	74.957
Calcium Carbonate, $CaCO_3$	9.20	157.804
Magnesium Carbonate, $MgCO_3$	3.06	52.487
Organic and Volatile Matter	17.46	299.485
Residue on Evaporation	40.88	701.200

Respectfully submitted,

HCP–EAG. ARTHUR D. LITTLE, Inc.

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